GAS TURBINE ENGINE WITH IMPROVED FUEL EFFICIENCY

RELATED APPLICATION

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 11/829,213, filed Jul. 17, 2007, and entitled "Gas Turbine Engine With Variable Geometry Fan Exit Guide Vane System," which is a continuation

BACKGROUND OF THE INVENTION

[0002] The present application relates to a gas turbine engine having an improved fuel consumption based upon a combination of operational parameters.

[0003] Gas turbine engines are known, and typically include a fan which drives air into a bypass duct, and also into a compressor section. The air is compressed in the compressor section, and delivered into a combustor section where it is mixed with fuel and burned. Products of this combustion pass downstream over turbine rotors, driving the turbine rotors to rotate.

[0004] In the past, a low pressure turbine has rotated at a given speed, and driven a low pressure compressor, and the fan at the same rate of speed. More recently, gear reductions have been included such that the fan in a low pressure compressor can be driven at different speeds.

SUMMARY OF THE INVENTION

[0005] In a featured embodiment, a gas turbine engine has a core section defined about an axis, a fan section delivering a first portion of air into the core section and a second portion of air into a bypass duct. A bypass ratio is defined as the ratio of the second portion compared to the first portion. The bypass ratio is greater than or equal to about 8.0. The air delivered into the core section is delivered into a low pressure compressor, and then into a high pressure compressor. Air from the high pressure compressor is delivered into a combustion section where it is mixed with fuel and ignited. Products of the combustion pass downstream over a high pressure turbine section and then a low pressure turbine section. An expansion ratio across the low pressure turbine section is greater than or equal to about 5.0. The low pressure turbine section drives the low pressure compressor section, and the fan through a gear reduction, with the gear reduction having a gear ratio greater than or equal to about 2.4.

[0006] In another embodiment according to the previous embodiment, the gear ratio is greater than or equal to about 2.5.

[0007] In another embodiment according to the previous embodiment, the gear ratio is less than or equal to about 4.2.

[0008] In another embodiment according to the previous embodiment, the expansion ratio is greater than or equal to about 5.7.

[0009] In another embodiment according to the previous embodiment, the bypass ratio is greater than or equal to 10.

[0010] In another embodiment according to the previous embodiment, the fan has an outer diameter that is greater than an outer diameter of the low pressure turbine section.

[0011] In another embodiment according to the previous embodiment, the gear reduction is greater than or equal to 2.4.

[0012] In another embodiment according to the previous embodiment, the gear reduction is less than or equal to 4.2.

[0013] In another embodiment according to the previous embodiment, the expansion ratio is greater than or equal to 5.0.

[0014] In another embodiment according to the previous embodiment, the bypass ratio is greater than or equal to 8.

[0015] In another featured embodiment, a method of operating a gas turbine engine includes the steps of driving a fan to deliver a first portion of air into a bypass duct and a second portion of air into a low pressure compressor. A bypass ratio of the first portion to the second portion is greater than or equal to 8.0. The first portion of air is delivered into the low pressure compressor, into a high pressure compressor, and then into a combustion section. The air is mixed with fuel and ignited. Products of the combustion pass downstream over a high pressure turbine, and then a low pressure turbine. The low pressure turbine section is operated with an expansion ratio greater than or equal to 5.0. The low pressure turbine section is driven to rotate, and in turn rotates the low pressure compressor and fan through a gear reduction. The gear reduction has a ratio of greater than or equal to 2.4.

[0016] In another embodiment according to the previous embodiment, the gear reduction is greater than or equal to 2.4.

[0017] In another embodiment according to the previous embodiment, the gear reduction is less than or equal to 4.2.

[0018] In another embodiment according to the previous embodiment, the expansion ratio is greater than or equal to 5.0.

[0019] In another embodiment according to the previous embodiment, the bypass ratio is greater than or equal to 8.

[0020] In another embodiment according to the previous embodiment, the fan has an outer diameter that is greater than an outer diameter of the low pressure turbine section.

[0021] In another featured embodiment, a gas turbine engine has a core section defined about an axis. A fan section is mounted at least partially around the core section to define a fan bypass flow path. A plurality of fan exit guide vanes are in communication with the fan bypass flow path and are rotatable about an axis of rotation to vary an effective fan nozzle exit area for the fan bypass flow path. The plurality of fan exit guide vanes are independently rotatable, and are simultaneously rotatable. The plurality of fan exit guide vanes are mounted within an intermediate engine case structure, with each including a pivotable portion rotatable about the axis of rotation relative a fixed portion. The pivotable portion includes a leading edge flap. A bypass ratio compares the air delivered by the fan section into a bypass duct to the amount of air delivered into the core section that is greater than 10, expansion ratio across a low pressure turbine section that is greater than 5, and the low pressure turbine section driving the fan section through a gear reduction, with the gear reduction having a ratio greater than 2.5.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The various features and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the currently preferred embodiment. The drawings that accompany the detailed description can be briefly described as follows:

[0023] FIG. **1**A is a general schematic partial fragmentary view of an exemplary gas turbine engine embodiment for use with the present invention;

[0024] FIG. **1**B is a perspective side partial fragmentary view of a FEGV system which provides a fan variable area nozzle;